

# Wakata gets station assembly flight seat

## Japanese astronaut to operate remote manipulator system robot arm

Japanese Astronaut Koichi Wakata will fly on STS-92, the third space shuttle mission to assemble the International Space Station, set for a January 1999 launch on *Atlantis*.

Wakata's assignment to the mission was announced by NASA Administrator Daniel S. Goldin and Japanese Science and Technology Agency Minister Riichiro Chikaoka, in Tokyo, Japan this month.

"NASA is honored to have Mr. Wakata participate in such an early and significant space station

assembly mission," Goldin said. "His participation on this flight is symbolic of the close bond that has developed between the American and Japanese space programs, and the extent to which we rely upon one another to meet our mutual objectives in space."

Wakata was selected as an astronaut in 1992 and has one previous space flight to his credit. He flew as a mission specialist on STS-72 in January 1996 aboard *Endeavour*. During that flight, the crew retrieved the orbiting Space

Flyer Unit satellite which was launched from Japan 10 months earlier, and deployed and retrieved the OAST-Flyer satellite.

On STS-92, he will be the primary operator of the shuttle's Remote Manipulator System robot arm supporting space station assembly tasks to be performed during four scheduled space walks. STS-92 is the fifth in a series of American and Russian assembly flights which will begin with the launch of the Functional Cargo Block in June 1998.

Prior to the arrival of *Atlantis* and the STS-92 crew, space station elements already delivered to orbit will include the Functional Cargo Block; Node 1 and two Pressurized Mating Adapters; the Service Module; and various logistical cargoes that will be carried aboard the second shuttle assembly mission in December 1998.

The remaining crew members will be named at a later date.

For information on the International Space Station, visit URL: <http://station.nasa.gov>



Koichi Wakata

# Fly-back rocket booster under study

NASA has awarded contracts for \$1 million each to Lockheed Martin and the Boeing Co. to study a possible future upgrade in which the rocket boosters that power the shuttle would fly back to the launch site.

To complement its in-house examination, Marshall Space Flight Center is asking each of the contractors for an in-depth concept definition on the liquid fly-back booster.

Proposals from industry will provide data and configuration studies for both the booster and its engine, focusing on the liquid fly-back booster concept—including analysis and evaluation model fabrication and wind-tunnel testing.

If the concept is implemented, the unpowered, liquid fly-back boosters would become the first-stage boosters of the space shuttle system.

Under the systems integration concept being studied, a shuttle launch using the upgraded booster would appear similar to the current system to an observer on the ground.

After separation from the shuttle, however, the two booster rockets would begin coasting for nine minutes, rather than parachuting into the ocean. Then jet engines would be started, and the unpowered boosters would fly back and land at KSC.

Other elements of the present shuttle system—including the orbiter, main engines and external tank—would remain essentially unchanged if the new boosters are incorporated.



NASA Photo 97-E-822

**Members of the STS-94 flight crew take a break in the white room at Launch Pad 39A during STS-83 Terminal Countdown Demonstration Test. The crew did not have to repeat the test for the STS-94 reflight. Standing from left are Payload Specialist Greg Linteris, Pilot Susan Stills, Commander Jim Halsell, Mission Specialist Mike Gernhardt, Payload Specialist Roger Crouch and Mission Specialist Don Thomas. Kneeling is Payload Commander Janice Voss.**

# Columbia gets new tiles prior to July launch

**By Kyle Herring**

Space Shuttle Program officials were scheduled to meet yesterday to select the official launch date for *Columbia's* reflight of the Microgravity Science Laboratory with only minor outstanding work remaining in the processing flow that could affect the schedule.

If all remains on schedule, the target launch date is July 1 with a 1:37 p.m. CDT liftoff at the opening of a two and a half hour launch window. Just after sunrise July 17 under this schedule, *Columbia* would land.

Vehicle Engineering Office experts continued to evaluate thermal protection system tiles on the forward reaction control system that have shown subsurface cracking attributed to the routine inspections of engine nozzles for each of the thruster jets around which the tiles are located.

While it is unknown how long the cracks have been there, managers said it was prudent to exchange those tiles for heavier ones that

can withstand the forces of the nozzle inspections that are suspected of causing the tiny cracks. Since the only way to determine if the tiles exhibit the cracking is by removing adjacent tiles, as many as 44 are being removed and replaced prior to launch. The other orbiters also are being inspected and tiles being replaced around the forward jets prior to their next flights.

The tile replacement work continued through the middle of this week before the pad was cleared for propellant loading. The remaining work on the tiles was to be addressed at yesterday's flight readiness review.

The reflight also will mark the fastest turnaround for a crew. Commander Jim Halsell, Pilot Susan Stills, Mission Specialists Janice Voss, Mike Gernhardt and Don Thomas, and Payload Specialists Roger Crouch and Greg Linteris will break the 128 day flight-to-flight record of Steve Nagel on STS-51G and STS-61A in 1985.



# Linenger: 'Biggest joy is conducting good experiments'

(Continued from Page 1)

Foale's Mir 23 crew mates, Commander Vasily Tsibliev and Flight Engineer Alexander Lazutkin are in the 124th day of their six-month mission. Tsibliev, Lazutkin and Foale completed repairs to a leaky cooling loop in Mir's Kvant-1 module last week. A cracked section that runs along the inner hull of the module was removed and replaced. The loop was reactivated and is now working normally.

With that repair complete, the trio was able to set up the new Elektron oxygen-generating unit delivered to Mir by *Altantis* last month. Installation was scheduled to be complete this week. The new unit will serve as a backup to the Elektron now working in Kvant-2.

Foale said he also has been busy with scientific research, particularly the fundamental biology experiment in which he's attempting to grow three generations of mustard plants

from one set of seeds. The ability to grow plants on orbit, as a source of food and oxygen, could be vital for sustaining life on future space stations and during interplanetary space flights.

The experiment work performed by Linenger, a medical doctor, included studies of sleep, physiology and photographic observations of the Earth, scientific work that he found among the most fulfilling aspects of his flight. He reported taking more than 10,000 photos of Earth during his 121 days in orbit.

"I've noticed that when I go by and see a map on the wall now, my mind flashes to a picture of what I had seen out the window," Linenger explained. "For example, when I see a map and I see the St. Lawrence Seaway, I can snap very quickly to the view out the window. I can see the ice flows and the break-up of those ice flows and almost run a film

through my mind. I feel like I know the Earth very well."

Physically, Linenger said his readaptation to Earth's gravity is going well, and he is using a variety of exercises, with swimming as a primary low-impact activity.

"It was much less difficult than I anticipated. For my rehab... the water felt like jello the first three days, like mercury the next few days, and now it is starting to feel like water again," he said. "I feel very much reaccimated. I feel very normal. On the other hand, when you look at the medical tests I do have some bone loss. I do have some muscle strength deficits, and being a physician and a sports medicine physician in particular, I realize you have to be very cautious until you get your strength back up."

Linenger said there are things he will miss about the Mir, and his experiment work will

likely be high among them. "One of the biggest joys is conducting good experiments. I felt much more like a scientist than I did during shuttle flights when you have someone always looking over your shoulder," he said. The camaraderie and sense of accomplishment a crew experiences as they work through problems aboard the station also was very satisfying, Linenger added.

But after a quarter of a year in orbit, the simplest things on Earth can become the most appealing.

"What I found as pleasurable as anything is the first morning back, I went out in my backyard, grabbed a bucket and started trimming my bushes and gardening," Linenger said. "Just watching cardinals fly by and just doing some basic things that we all take for granted, I was in heaven in my backyard with all the green and the flowers and the trees."

# Green, edible aircraft anti-icing fluid saves environment

Combining increased efficiency with environmental safety, a NASA-developed fluid promises to make flying safer without introducing dangerous chemicals into the environment and may reduce corrosion on cars.

A three-engineer team at NASA's Ames Research Center designed the non-toxic fluid to keep ice from building up on airplanes. It is so environmentally safe that it has been referred to as "food grade," because the ingredients used in its creation have been approved by the Food and Drug Administration for use in food. When used in bulk, the NASA de-icer poses significantly less of an environmental hazard than chemicals currently in use.

"The new fluid also can increase flight safe-

ty, in keeping with one of NASA's major goals," fluid co-inventor Leonard Haslim of Ames said. "The food grade anti-icing fluid not only works as well as, or better than available fluids, but it is the only one that is non-toxic and totally biodegradable."

The invention also may save money now being spent to meet the Clean Water Act, he added. "The fluid can be put on runways, bridges, ships and automobiles, as well."

"When you look at the high costs of rust and other salt damage to cars, bridges, roads and the environment, it's obvious that using this new anti-icing fluid can save a lot of money," Haslim said. "You can even spray the stuff on your windshield the night before you go to work, and the next morning, the

wiper blades will easily push the ice completely off the glass," he added.

Anti-icing fluids used today can sicken or kill water life, animals and humans due to ingredients such as ethylene glycol and additives. The new fluid contains propylene glycol that may be food grade, according to co-inventor, John Zuk, also of Ames.

Worldwide, about a half a billion gallons of aircraft de-icing fluid are used annually. Much of it could be replaced by the new non-toxic fluid, according to Haslim.

The anti-icing fluid will "grab" onto an airplane's surface better than current fluids when a plane is at rest. "Our new fluid produces a long-lasting barrier to ice build-up. But when the plane takes off, the fluid suddenly gets

thinner, and it blows away so the wings are clean and have plenty of 'lift' force as the plane rises," explained Robert Lockyer, the third co-inventor on the Ames team.

"I compare the green-colored fluid to lime sherbet when it's on the wing and limeade when the plane is moving," said Haslim.

The new fluid is neutral, neither an acid nor a base, and is non-conductive. It appears to be harmless to aircraft, pavement, bridges and vehicles, according to Haslim. "It shouldn't hurt plants, either," he said.

The Ames fluid is now under test by government and industry for aircraft use. Comparison tests will be run against corrosive de-icing salts as well as other de-icing materials, such as calcium magnesium acetate.